ESTABLISHMENT OF AQUATIC BASELINES IN LARGE INLAND IMPOUNDMENTS

Segment 1 and 2 Report
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INTRODUCTION

As in previous years, this report contains information concerning the relative abundance, distribution and reproductive success of commercial, forage and sport fish populations in Fort Peck Reservoir.

This report also includes information on zooplankton populations and physical limnology from several reservoir locations. Data concerning these parameters was added because it is felt that they strongly influence the distribution, abundance and growth of all fish species within the reservoir.

The primary study objectives during this report period were to: (1) Monitor commercial fish populations and harvest by commercial fishermen, with special emphasis on goldeye; (2) Monitor spring spawning activities of commercial and sport fish species by trapping at several locations throughout the reservoir, particularly the Big Dry Arm; (3) Determine distribution and relative abundance of various fish species and the influence of zooplankton populations and physical limnology on the overall fish community; (4) Determine spawning success of sport, commercial and forage fish species by conducting late summer and early fall beach seining.

A map of the study area is shown in Figure 1.

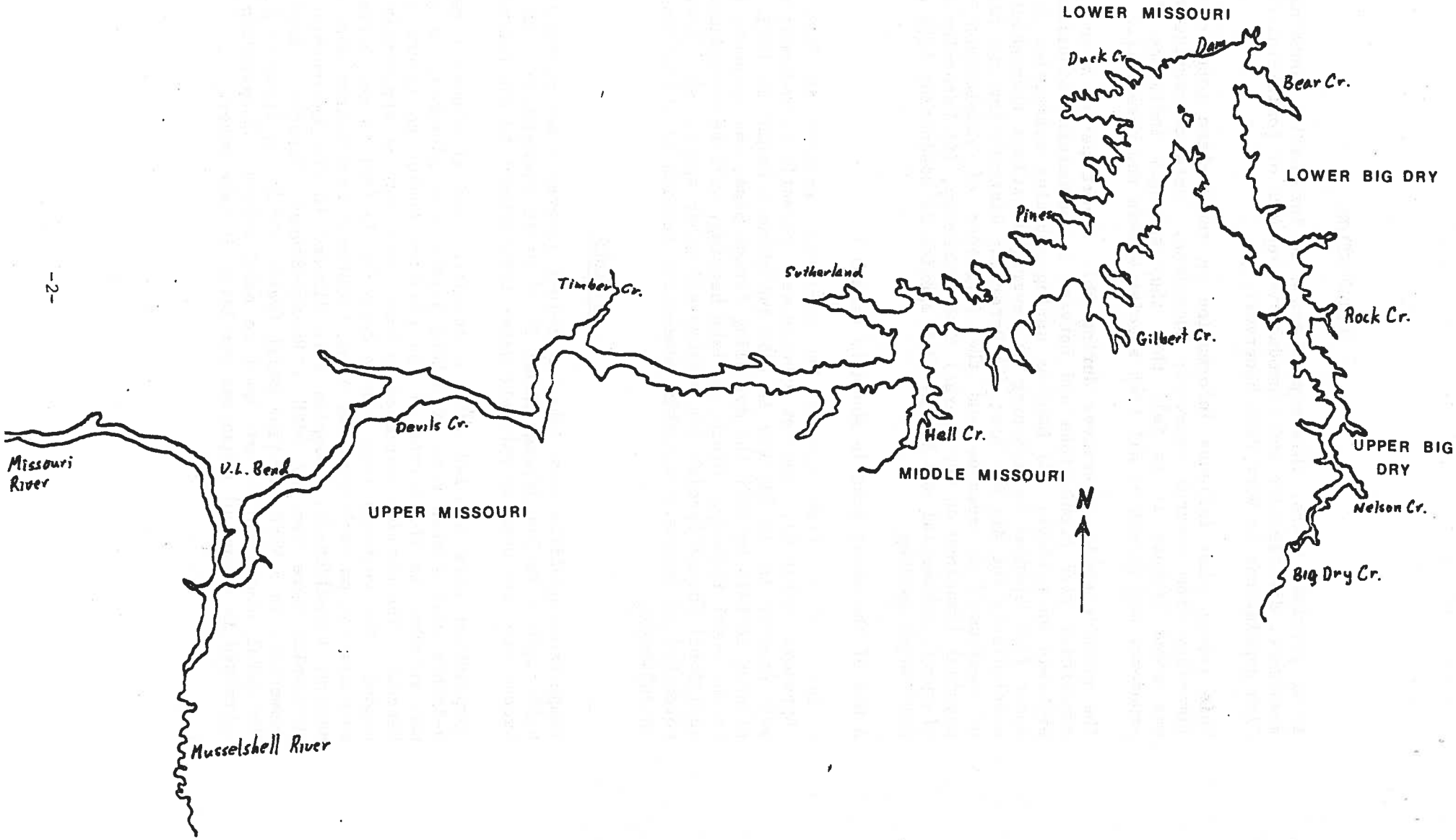
A total of 45 fish species are currently present in Fort Peck Reservoir (Appendix, Table 1). Two new species were recently introduced; spottail shiners were stocked in the Big Dry in 1982 and chinook salmon in 1983. Spottails were planted to help bolster the dwindling forage base, and chinook, to add diversity to the sport fishery. Cisco, or lake herring, will be introduced in 1984, as an additional forage species for walleye and other sport fish. Cisco also have the potential to become a valuable commercial species if a high population density is achieved.

METHODS

Temperature profiles were taken at 5-foot intervals and measured to the nearest 0.5°c with a Yellow Springs Model 54 electric thermometer. An 8-inch diameter Secchi disc was used to estimate water transparency to the nearest 0.5 feet.

Zooplankton were sampled with a standard conical plankton net 12- x 40- x 4-inches with a mesh size of 0.0063 inches (160 microns). A two pound weight was attached to the bottom of the plankton bucket to insure a rapid vertical descent. The net was retrieved by hand, at a rate of approximately 1.7 feet per second. Two vertical tows from a depth of 25-feet to the surface were made at each station on each sampling date. Captured zooplankton were preserved in 10 percent formaldehyde. Samples were diluted in the laboratory and three 2 ml subsamples were removed with a Hensen-Stempel Pipette. Each subsample was enumerated in a Ward counting wheel (Ward, 1955). A dissecting microscope with 30x total magnification was used to make counts. Zooplankton densities were expressed in number of organisms per liter of lake water.

Figure 1. Map of Fort Peck Reservoir depicting principal fish sampling areas, 1982 and 1983.



Fish populations were sampled in early spring with 4- x 6-foot frame traps constructed of 1-inch square mesh. Leads 50 feet long with square mesh sizes of 1-inch or 1½-inch were attached to shore. Traps were usually checked every two to three days, depending on number of fish being captured.

Walleye and northern pike were fin-clipped to indicate previous capture. Selected species of fish were sexed, weighed and measured, and all species were identified and counted.

Experimental gill nets, 125- x 6-feet were used to monitor fish distribution and composition in late summer and early fall. Each net contained five panels, 25 feet in length, with square mesh sizes of 3/4, 1-, 1 1/4-, 1 1/2-, and 2 inches.

Spawning success of forage minnows and young-of-year fish were sampled in late summer and early fall with 100 -x 10-foot beach seine. Square mesh sizes were 1/4-inch or 3/16-inch.

Floating gill nets 300- x 8-feet were used to sample goldeye at standard monitoring sites in the North Fork of Duck Creek. The monofiliment nets contained variable square mesh sizes from 1 1/4-inch to 1 3/4-inch. All captured goldeye were sexed, weighed and measured. Nets were set at night periodically throughout the fishing season. Commercial goldeye catches were sampled at one fish plant shortly after removal from the lake.

TRAPPING

Frame traps were used to capture spring spawning fish at various locations throughout the reservoir during 1982 and 1983.

In the upper Big Dry Arm traps were run a total of 89 trap-days, from April 21-May 7 during 1982. Captured fish totaled 2,037, an average of 22.9 fish per trap-day (Table 1). The average total lengths, weights and ranges of trapped fish are shown in Table 2. In 1983 a total of 1,703 fish were captured during 106 trap-days, from April 6-May 9, (Table 3). An average of 16.1 fish were taken per trap-day. Size data on fish trapped in 1983 is shown in Table 4.

Walleye were the most abundant fish species trapped in the upper Big Dry during both years. In 1982, a total of 655 walleye were taken, averaging 7.4 fish per trap-day. Male walleye comprised 86 percent of the walleye captured and females made up 9 percent. Those of undetermined sex comprised the remaining 4 percent. In 1983, a total of 725 walleye were captured, averaging 6.8 fish per trap-day. Males were again the dominant sex, constituting 89 percent of the total captured. Females made up 5 percent and those of undetermined sex comprised the remaining 6 percent. Walleyes that were marked in 1981 and recaptured during 1982 made up 4 percent of total walleye catch. In 1983 the number of recaptures from the previous year's marking made up 12 percent of the total walleye catch.

Northern pike were the second most abundant game fish captured during both years. In 1982 a total of 218 northern pike were captured, averaging 2.4 fish per trap-day. Males made up 42 percent of the total northerns taken, females comprised 50 percent and unknowns, 8 percent. Northerns marked in 1981 and recaptured in 1982, made up 3 percent of the total northern catch. In 1983, recaptures from the previous year's marking comprised 7 percent of the total catch. A total of 87 northerns were trapped in 1983, averaging 0.8 fish per trap-day. Males made up 24 percent of the total northern catch and females contributed 34 percent. Northerns of undetermined sex made up 42 percent.

Table 1. Species and number of fish trapped at various locations on Fort Peck Reservoir in 1982. Numbers in parentheses are the number of fish caught per trap-day

Location[2]	SPECIES[1] WE	NP	SG	YP	BU	GE	WS	RC	SB	C	RS	BB	CC	FD	SM	RB	BC	LT	BH	Total Fish	Trap Days
Upper Big Dry Arm	655 (7.4)	218 (2.4)	18 (0.2)	58 (0.7)	11 (2.2)	151 (1.7)	197 (2.2)	355 (4.0)	70 (0.8)	191 (2.1)	90 (1.0)	4 (<0.1)	16 (0.2)			2 (<0.1)			1 (<0.1)	2037 (22.9)	89
Mid Big Dry Arm	25 (0.6)	86 (2.0)	4 (0.1)	8 (0.2)	2 (<0.1)	2 (<0.1)	8 (0.2)	10 (0.2)	24 (0.6)	66 (1.6)	1 (<0.1)	1 (<0.1)	2 (<0.1)							239 (5.7)	42
Lower Big Dry Arm	3 (<0.1)	94 (1.6)	5 (<0.1)		3 (<0.1)		11 (0.2)			50 (0.8)	1 (<0.1)	1 (<0.1)	1 (<0.1)		1 (<0.1)					170 (2.8)	60
Lower Missouri Arm	25 (0.3)	246 (3.3)	21 (0.3)	1 (<0.1)	7 (0.1)	10 (0.1)	87 (1.2)	1 (<0.1)	2 (<0.1)	94 (1.3)				1 (<0.1)			4 (<0.1)			492 (6.6)	75

[1] WE= walleye; NP= northern pike; SG= sauger; YP= yellow perch; BU= burbot; GE= goldeye; WS= white sucker; RC= river carpsucker; SB= smallmouth buffalo; C= carp; RS= shorthead redhorse sucker; BB= bigmouth buffalo; CC= channel catfish; FD= freshwater drum; SM= smallmouth bass; RB= rainbow trout; BC= black crappie; LT= lake trout; BH= black bullhead

[2] Upper Big Dry: Big Dry Cr. Bay, Nelson Cr. Bay

Mid Big Dry Arm: McGuire Cr. Bay, Lone Tree Cr. Bay, Big Creek Bay

Lower Big Dry Arm: Rock Cr. Bay, Box Cr. Bay, Sandy Arroyo Bay, Box Elder Cr. Bay, Spring Cr. Bay

Lower Missouri Arm: Duck Cr. Bay, Marina, Milk Coulee Bay, Bear Cr. Bay

Table 2. Average lengths, weights and ranges for various fish species captured in frame traps in the Upper Big Dry in 1982.

Species	No.	$\bar{x}$ Total Length	$\bar{x}$ Total Weight
Walleye (M)	565	15.1(10.9-22.8)	1.07(.33-3.70)
Walleye (F)	58	21.1(11.0-26.5)	2.95(.40-5.60)
Walleye (?)	32	12.8(10.3-18.5)	0.60(.27-1.67)
Sauger (M)	7	15.0(12.3-17.6)	0.91(.48-1.38)
Sauger (F)	5	19.4(18.7-20.1)	2.20(1.95-2.66)
Sauger (?)	6	19.1(17.9-20.4)	1.76(1.48-2.15)
Northern pike (M)	91	24.9(19.2-33.2)	3.66(1.55-9.00)
Northern pike (F)	109	31.8(24.5-43.0)	8.94(3.46-21.0)
Northern pike (?)	18	30.8(24.0-41.0)	7.13(2.77-17.10)
Yellow perch	58	8.3(6.3-10.8)	0.28(.13- .85)
River carpsucker	355	--	--
Shorthead redhorse sucker	90	--	--
White sucker	197	--	--
Smallmouth buffalo	70	--	--
Carp	191	--	--
Channel catfish	16	13.8(12.3-25.9)	1.08(.13-7.4)
Burbot	11	25.6(17.6-30.6)	3.75(1.04-6.0)

*(?) indicates sex of fish could not be determined.

Table 3. Species and number of fish trapped at various locations on Fort Peck Reservoir in 1983. Numbers in parentheses are the number of fish caught per trap-day

Location[2]	SPECIES[1]																			Total Fish	Trap Days
	WE	NP	SG	YP	BU	GE	WS	RC	SB	C	RS	BB	CC	FD	SM	RB	BC	LT	LS		
Upper Big Dry Arm	725	87	48	42	13	26	65	370	66	97	129	1	28	3	1	2				1703	106
	(6.8)	(0.8)	(0.5)	(0.4)	(0.1)	(0.2)	(0.6)	(3.5)	(0.6)	(0.9)	(1.2)	(<0.1)	(0.3)	(<0.1)	(<0.1)	(<0.1)				(16.1)	
Lower Missouri Arm	44	142	34		7	20	42	1		53	6						3			348	126
	(0.3)	(1.1)	(0.3)		(<0.1)	(0.2)	(0.3)	(<0.1)		(0.4)	(<0.1)						(<0.1)			(2.8)	
Mid Missouri Arm	1	99	15	1	1	1	1			28							1			148	22
	(<0.1)	(4.5)	(0.7)	(<0.1)	(<0.1)	(<0.1)	(<0.1)			(1.3)							(<0.1)			(6.7)	
Upper Missouri Arm		37	35	10	4	156	1	57		8	57	1	7		1		52	1	1	428	8
		(4.6)	(4.4)	(1.3)	(0.5)	(19.5)	(0.1)	(7.1)		(1.0)	(7.1)	(0.1)	(0.9)		(0.1)		(6.5)	(0.1)	(0.1)	(53.5)	

[1] WE= walleye; NP= northern pike; SG= sauger; YP= yellow perch; BU= burbot; GE= goldeye; WS= white sucker; BC= river carpsucker; SB= smallmouth buffalo; C= carp; RS= shorthead redhorse sucker; BB= bigmouth buffalo; CC= channel catfish; FD= freshwater drum; SM= smallmouth bass; RB= rainbow trout; BC= black crappie; LT= lake trout; LS= longnose sucker

[2] Upper Big Dry: Big Dry Cr. Bay, Nelson Cr. Bay

Lower Missouri: Duck Cr. Bay, Marina, Milk Coulee Bay, Bear Cr. Bay

Mid Missouri: Hell Cr. Bay, Gilbert Cr Bay, Pines Bay

Upper Missouri: Musselshell R. Bay

Table 4. Average lengths, weights and ranges for various fish species captured in frame traps in the Upper Big Dry in 1983.

Species	No.	$\bar{x}$ Total Length	$\bar{x}$ Total Weight
Walleye (M)	644	13.8(11.0-22.2)	0.80(.38-2.75)
Walleye (F)	37	21.8(13.4-27.5)	3.24(.68-6.75)
Sauger (M)	19	14.7(17.8-12.3)	0.82(.45-1.32)
Sauger (F)	12	18.4(16.2-19.7)	1.66(1.21-2.05)
Northern pike (M)	21	27.5(22.3-38.3)	4.84(2.28-12.80)
Northern pike (F)	30	32.9(25.9-41.0)	8.60(3.70-15.00)
Yellow perch	9	7.3(6.7- 8.3)	0.18(.12- .30)
River carpsucker	370	--	--
Shorthead redhorse sucker	129	--	--
White sucker	65	--	--
Smallmouth buffalo	66	--	--
Carp	97	--	--
Channel catfish	28	16.3(6.2-28.2)	1.36(.07-4.55)
Burbot	12	19.8(14.8-28.9)	1.87(.56-5.83)

Only 18 sauger were trapped in 1982 in the upper Big Dry, none of which had been marked the previous year. Forty-eight sauger were taken in 1983, no recaptures from the previous year were observed. Males were the dominant sex in both years.

Other game fish captured in 1982 included, 11 burbot, 16 channel catfish and 2 rainbow trout. The most predominant nongame species was river carpsucker. A total of 355 were captured, averaging nearly 4 fish per trap-day. Other nongame species captured included, 197 white sucker, 191 carp, 151 goldeye, 90 shorthead redhorse sucker, 70 smallmouth buffalo, 58 yellow perch, 4 bigmouth buffalo and 1 black bullhead.

Other game fish trapped in 1983 were; 13 burbot, 28 channel catfish, 2 rainbow trout and 1 smallmouth buffalo, 65 white sucker, 42 yellow perch, 26 goldeye, 3 freshwater drum and 1 bigmouth buffalo.

In the mid-Big Dry Arm, frame traps were run for 42 trap-days, from May 7-May 14, 1982. A total of 239 fish were captured, averaging 5.7 fish per trap-day. No traps were set in this area during the spring of 1983. The dominant game fish captured was northern pike, which averaged 6.21 pounds. The average number taken per trap-day was 2.0. Walleye averaged 1.06 pounds, and were the second most abundant game fish captured. The average catch of walleye per trap-day was 0.6 fish. The most dominant nongame fish was carp, averaging 1.6 fish per trap-day. Other species of fish captured are listed in Table 1.

Frame traps in the lower Big Dry Arm captured 170 fish over 60 trap-days during May 14-24, 1982. No traps were run in this area in 1983. Northern pike were the most abundant game fish captured, averaging 1.4 per trap-day. The average weight of northerns was 4.11 pounds. The most abundant nongame species was carp. The average number of carp taken per trap-day was 0.8. Other game and nongame fish captured in 1982 are shown in Table 1.

Spring trapping was conducted in the lower Missouri Arm during May 11-May 27, 1982, and April 26-May 25, 1983. Traps were set for 75 trap-days in 1982, capturing 492 fish, (6.6 fish per trap-day). In 1983, trapping continued for 126 trap-days, capturing a total of 348 fish, (2.8 per trap-day). The dominant game fish for both years was northern pike. The average number of northerns captured in 1982 was 3.3 per trap-day. In 1983, the average was 1.1. The mean weight of northerns was 4.66 pounds and 5.70 pounds for 1982 and 1983, respectively. Walleye were the second most abundant game fish during both years, catches averaged 0.3 per trap-day. The mean weight for walleye was 0.95 pounds for both years. Carp were the most dominant nongame species, the average number taken per trap-day was 1.2 and 0.4 for each respective year. Other fish species captured are shown in Tables 1 and 3. Frame traps were set for 22 trap-days in the mid-Missouri Arm from May 18-May 26, 1983. A total of 148 fish were captured, averaging 6.7 per trap-day. Northern pike were the dominant species, averaging 4.5 fish per trap-day. Weights of northerns averaged 6.35 pounds. Sauger were the second most abundant game fish, averaging 0.7 fish per trap-day. The mean weight was 1.02 pounds. The predominant nongame fish captured was carp, (1.3 per trap-day). No traps were run in the mid-Missouri Arm in the spring of 1982.

Trapping in the upper Missouri arm was also conducted only during 1983. Traps were run from April 19-21. A total of 428 fish were captured in 8 trap-days, (53.5 fish per trap-day). The dominant game fish was northern pike (4.6 per trap-day), followed closely by sauger (4.4 per trap-day). Northerns averaged 6.90 pounds and sauger 0.82 pounds. Goldeye were the most abundant fish captured, averaging 19.5 per trap-day. Other species of fish captured are shown in Table 3.

GILL NETTING

Experimental gill nets were set at several locations throughout the reservoir to obtain information on fish species distribution and abundance. During 1982, gill nets were fished from July 27-September 23, and from July 25-August 25, in 1983. The results of this sampling are shown in Tables 5 and 6.

Fish netted in the upper Big Dry Arm were dominated by goldeye during both years. Goldeye comprised 58 percent of the catch in 1982, and 32 percent in 1983. The second most abundant fish during both sampling years, was channel catfish, which made up 20 percent of the catch in 1982, and 27 percent in 1983.

Goldeye dominated the catch in the lower Big Dry Arm during both years of sampling, making up 35 percent of the total in 1982, and 39 percent in 1983. Walleye were the second most abundant fish, comprising 22 and 14 percent of the total catch in 1982 and 1983, respectively.

In the lower Missouri Arm, walleye were again ranked second in abundance, making up 9 percent of the catch in 1982 and 12 percent in 1983. The dominant fish species captured was goldeye, which comprised 72 percent of the population in 1982 and 67 percent the following year.

Sauger were the second most abundant fish species in the mid Missouri Arm during both years, and goldeye were again ranked first. During 1982, goldeye made up 76 percent of the population, and 59 percent in 1983. Sauger comprised 7 percent of the total in 1982 and 14 percent in 1983.

In the upper Missouri Arm, goldeye made up 57 percent of the catch in 1982, and 67 percent in 1983. Sauger were second in abundance, comprising 21 percent of the catch in 1982 and 13 percent in 1983. Yellow perch were almost as abundant in 1983, and made up 11 percent of the total.

BEACH SEINING

Age 0 fish and forage minnows were obtained by seining various bays throughout the reservoir during August through October in 1982, and August through September in 1983. Results of seining activities are shown in Tables 7 and 8.

Seining in the upper Big Dry Arm, captured a total of 6,266 fish in 30 hauls during 1982. Thirty-nine seine hauls were conducted in 1983, capturing 1,776 fish.

Table 5. Summary of fish species captured in Fort Peck Reservoir with 125-foot experimental gill nets in 1982. The number of fish caught per net day is in parentheses.

Location[2]	SPECIES[1] WE	NP	SG	YP	GE	WS	RC	SB	C	RS	BB	CC	FD	CR	SS	Total No.	Net Days
UPPER BIG DRY	41		2	6	197		14	1	4	3		71				339	6
	(6.8)		(0.3)	(1.0)	(32.8)		(2.3)	(0.2)	(0.7)	(0.5)		(11.8)				(56.5)	
LOWER BIG DRY	28	2	7	15	45		4	1	5	5		14			1	127	6
	(4.7)	(0.3)	(1.2)	(2.5)	(7.5)		(0.7)	(0.2)	(0.8)	(0.8)		(2.3)			(0.2)	(21.2)	
LOWER MISSOURI	42	5	24	12	342	4	2	3	24		2	16		1		477	12
	(3.5)	(0.4)	(2.0)	(1.0)	(28.5)	(0.3)	(0.2)	(0.3)	(2.0)		(0.2)	(1.3)		(0.1)		(39.8)	
MID MISSOURI	7	4	14	11	146		2		5		1			1		191	12
	(0.6)	(0.3)	(1.2)	(0.9)	(12.2)		(0.2)		(0.4)		(0.1)			(0.1)		(15.9)	
UPPER MISSOURI	4		113	18	301	1	13		5	23		10	18	19		525	9
	(0.4)		(12.6)	(2.0)	(33.4)	(0.1)	(1.4)		(0.6)	(2.6)		(1.1)	(2.0)	(2.1)		(58.3)	
Totals	122	11	160	62	1031	5	35	5	43	31	3	111	18	21	1	1659	45
	(2.7)	(0.2)	(3.6)	(1.4)	(22.9)	(0.1)	(0.8)	(0.1)	(0.9)	(0.7)	(0.1)	(2.5)	(0.4)	(0.5)	(0.1)	(36.9)	

[1] WE = walleye; NP = northern pike; SG = sauger; YP = yellow perch; GE = goldeye; WS = white sucker; RC = river carpsucker; SB = smallmouth buffalo; C = carp; RS = shorthead redhorse; BB = bigmouth buffalo; CC = channel catfish; FD = freshwater drum; CR = crappie sp.; SS = shovelnose sturgeon

[2] UPPER BIG DRY: Nelson Creek, Lone tree Creek. LOWER BIG DRY: S.F. Rock Creek, Box Elder Creek. LOWER MISSOURI: Bear Creek, Duck Creek. MID MISSOURI: Pines, Sutherland Creek. UPPER MISSOURI: Timber Creek, Fourchett Creek, Musselshell Bay

Table 6. Summary of fish species captured in Fort Peck Reservoir with 125-foot experimental gill nets in 1983. The number of fish caught per net day is in parentheses.

Location[2]	SPECIES[1] WE	NP	SG	YP	BU	GE	WS	RC	SB	C	RS	BB	CC	FD	SM	CR	LT	Total No.	Net Days
UPPER BIG DRY	72 (4.8)	4 (0.3)	3 (0.2)	32 (2.1)		148 (9.9)	1 (0.1)	22 (1.5)	13 (0.9)	33 (2.2)	4 (0.3)	2 (0.1)	125 (8.3)					459 (30.6)	15
LOWER BIG DRY	39 (2.2)	23 (1.3)	10 (0.6)	24 (1.3)		108 (6.0)		3 (0.2)	3 (0.2)	27 (1.5)	15 (0.8)	1 (0.1)	21 (1.2)	2 (0.1)				276 (15.3)	18
LOWER MISSOURI	32 (2.7)		11 (0.9)	4 (0.3)	1 (0.1)	180 (15.0)	6 (0.5)	1 (0.1)		20 (1.7)	2 (0.2)	1 (0.1)	9 (0.8)					267 (22.3)	12
MID MISSOURI	54 (2.6)	12 (0.6)	92 (4.4)	55 (2.6)		379 (18.0)	16 (0.8)	1 (< 0.1)		19 (0.9)	7 (0.3)		3 (0.1)	3 (0.1)	2 (0.1)			643 (30.6)	21
UPPER MISSOURI	6 (0.3)	1 (0.1)	171 (9.5)	149 (8.3)		889 (49.4)	1 (0.1)	26 (1.4)	2 (0.1)	14 (0.8)	25 (1.4)		3 (0.2)	27 (1.5)	2 (0.1)	6 (0.3)	1 (0.1)	1323 (73.5)	18
Totals	203 (2.4)	40 (0.5)	287 (3.4)	264 (3.1)	1 (< 0.1)	1704 (20.2)	24 (0.3)	53 (0.6)	18 (0.2)	113 (1.3)	53 (0.6)	4 (< 0.1)	161 (1.9)	32 (0.4)	4 (< 0.1)	6 (0.1)	1 (< 0.1)	2968 (35.3)	84

[1] WE = walleye, NP = northern pike, SG = sauger, YP = yellow perch, BU = burbot, GE = goldeye, WS = white sucker, RC = river carpsucker, SB = smallmouth, C = carp, RS = shorthead redhorse, BB = bigmouth buffalo, CC = channel catfish, FD = freshwater drum, SM = smallmouth bass, CR = crappie, LT = lake trout

[2]
UPPER BIG DRY: Big Dry Creek, Nelson Creek, McGuire Creek, Lone Tree Creek, Short Creek

LOWER BIG DRY: Box Creek, N. & S. Frk. Rock Creeks, Box Elder Creek, Sandy Arroyo Creek, Spring Creek

LOWER MISSOURI: Bear Creek, Duck Creek, Milk Coulee Bay

MID MISSOURI: Pines, Gilbert Creek, Crooked & Cattle Creeks, Hell Creek, Sutherland Creek, Snow Creek

UPPER MISSOURI: Timber Creek, Seven Black Foot Creek, Fourchett Creek, Musselshell Bay, Crooked Creek, Soda Creek

Table 7. Species and number of forage minnows and young-of-year fish captured by seining Fort Peck Reservoir 1982. The number of fish per seine haul is in parentheses.

Location[2]	Species[1]																						Total Catch	No. Hauls
	WE	NP	SG	YP	BU	GE	WS	RC	Bspp	C	SR	CC	FD	SMB	SM	CR	LN	SS	FC	FM	ES	LC		
UPPER BIG DRY	4	1460					126	48	1857	378	22	1	8		1125	10	6	186	9	631	73	322	6266	30
	(0.1)	(48.7)					(4.2)	(1.6)	(61.9)	(12.6)	(0.7)	(<0.1)	(0.3)		(37.5)	(0.3)	(0.2)	(6.2)	(0.3)	(21.0)	(2.4)	(10.7)	(209)	
LOWER BIG DRY	18	21	6	2197		1	829	203	1754	189	1		7		5	2		1		3	88	8	5333	40
	(0.5)	(0.5)	(0.1)	(54.9)		(<0.1)	(20.7)	(5.1)	(43.9)	(4.7)	(<0.1)		(0.1)		(0.1)	(<0.1)		(<0.1)		(0.1)	(2.2)	(0.2)	(133)	
LOWER MISSOURI	90	13	3	483	2	5	125	14	217	29			7	11	11	606					1251	2	2869	58
	(1.5)	(0.2)	(0.1)	(8.3)	(<0.1)	(0.1)	(2.2)	(0.2)	(3.7)	(0.5)			(0.1)	(0.2)	(0.2)	(10.4)					(21.6)	(<0.1)	(49)	
MID-MISSOURI	2		6	4315		143	175	8	601	98			519	12	64	4981			1		619	1	11,545	41
	(<0.1)		(0.1)	(105.2)		(3.5)	(4.3)	(0.2)	(14.7)	(2.4)			(12.7)	(0.3)	(1.6)	(121.5)			(<0.1)		(15.1)	(<0.1)	(282)	
UPPER MISSOURI	2		98	1149		1261	137	14	148	47	3		117		176	1359			39		733		5283	26
	(0.1)		(3.8)	(44.2)		(48.5)	(5.3)	(0.5)	(5.7)	(1.8)	(0.1)		(4.5)		(6.8)	(52.3)			(1.5)		(28.2)		(203)	

[1] WE = walleye; NP = northern Pike; SG = sauger; YP = yellow perch; BU = burbot; GE = goldeye; WS = white sucker; RC = river carpsucker; Bspp = smallmouth/bigmouth buffalo; C = carp; SR = shorthead redhorse sucker; CC = channel catfish; FD = freshwater drum; SMB = smallmouth bass; SM = silvery/plains minnow; CR = black/white crappie; LN = longnose dace; SS = sand shiner; FC = flathead chub; FM = fathead minnow; ES = emerald shiner; LC = lake chub

[2] Upper Big Dry = Stone House, Nelson Cr., McGuire Cr., Lone Tree Cr., and Bug Cr.
Lower Big Dry = S.F. Rock Cr., Box Cr., Sandy Arroyo, Box Elder Cr., and Spring Cr.
Lower Missouri = Duck Cr., Marina Bay, Spillway, Bear Cr.
Mid-Missouri = Sutherland, Hell Cr., Pines and Gilbert Cr.
Upper Missouri = Crooked Cr., Musselshell Bay, Fourchett Cr., and Timber Cr.

Table 8. Species and number of forage minnows and young-of-year fish captured by seining in Fort Peck Reservoir 1983. The number of fish per seine haul is in parentheses.

Location[2]	Species[1]																						Total Catch	No. Hauls
	WE	NP	SG	YP	BU	GE	WS	RC	Bsp	LT	C	SR	CC	FD	SMB	SM	CR	LS	SS	FC	FM	ES	ST	
UPPER BIG DRY	8	21		454			3	65	289		253		5	49	53	102			6	9	33	275	151	1,776	39
	(0.2)	(0.5)		(11.6)			(0.1)	(1.7)	(7.4)		(6.5)		(0.1)	(1.3)	(1.4)	(2.6)			(0.1)	(0.2)	(0.8)	(7.0)	(3.9)	(45)	
LOWER BIG DRY	7	48	2	1784	1	2	248	104	864		438	1		2		2	1			43	9	1530	413	5,499	59
	(0.1)	(0.8)	(<0.1)	(30.2)	(<0.1)	(<0.1)	(4.2)	(1.8)	(14.6)		(7.4)	(<0.1)		(<0.1)		(<0.1)	(<0.1)			(0.7)	(0.1)	(25.9)	(7.0)	(93)	
LOWER MISSOURI	10	1		584	1	1	719	5	565	1	197			6			1178		3	2	1	490	1114	4,878	69
	(0.1)	(0.1)		(8.5)	(<0.1)	(<0.1)	(10.4)	(0.1)	(8.2)	(<0.1)	(2.9)			(0.1)			(17.0)		(<0.1)	(<0.1)	(<0.1)	(7.1)	(16.1)	(71)	
MID-MISSOURI	4			2734			74	1	478		322			2	21		4942			12		2373	3	10,966	41
	(0.1)			(66.7)			(1.8)	(<0.1)	(11.7)		(7.8)			(<0.1)	(0.5)		(120.5)			(0.3)		(57.9)	(0.1)	(267)	
UPPER MISSOURI	23		68	2768		2599	76	275	149		372			186	3	7	3123	4		463		1191		11,307	55
	(0.4)		(1.2)	(50.3)		(47.3)	(1.4)	(5.0)	(2.7)		(6.8)			(3.4)	(<0.1)	(0.1)	(56.8)	(0.1)		(8.4)		(21.6)		(206)	

[1] WE = walleye; NP = northern pike; SG = sauger; YP = yellow perch; BU = burbot; GE = goldeye; WS = white sucker; RC = river carpsucker; Bsp = smallmouth/bigmouth buffalo; LT = lake trout; C = carp; SR = shorthead redhorse sucker; CC = channel cat; FD = freshwater drum; SMB = smallmouth bass; SM = silvery/plains minnow; CR = black/white crappie; LS = longnose sucker; SS = sand shiner; FC = flathead chub; FM = fathead minnow; ES = emerald shiner; ST = spottail shiner

[2] UPPER BIG DRY = Stone House, Nelson Cr., Lone Tree, and McGuire Cr.
LOWER BIG DRY = Box Cr., S.F. Rock Cr., Box Elder Cr., Sandy Arroyo Cr., and Spring Cr.
LOWER MISSOURI = Bear Cr., Duck Cr., Catfish Bay, Sturgeon Bay and Spillway Bay
MID-MISSOURI = Pines, Gilbert Cr., Hell Cr. and Sutherland
UPPER MISSOURI = Timber Cr., Blackfoot Cr., Fourchett Cr., Devils Cr., Musselshell, Crooked Cr., and Soda Cr.

The most abundant species captured in 1982 was young-of-year (YOY) buffalo sp., which made up 30 percent of the catch. Yellow perch (YOY) comprised 23 percent; silvery/plains minnows, 18 percent; fathead minnows, 10 percent; carp (YOY), 6 percent; lake chub, 5 percent and emerald shiners 1 percent. Other species comprised less than 1 percent individually.

Yellow perch (YOY) were the most predominant species seined in 1983, making up 26 percent of the total catch. Buffalo sp. (YOY) comprised 16 percent; emerald shiners, 15 percent; carp (YOY), 14 percent; spottail shiners, 9 percent; silvery/plains minnows, 6 percent; river carpsucker (YOY), 4 percent; freshwater drum (YOY), and smallmouth bass (YOY), 3 percent each; fathead minnows 2 percent and northern pike (YOY), 1 percent.

Seining in the lower Big Dry Arm captured a total of 5,333 fish in 40 seine hauls during 1982. Fifty-nine seine hauls in 1983 produced 5,499 fish.

The dominant species in 1982 was yellow perch, which made up 41 percent of the total catch. Buffalo sp. (YOY) comprised 33 percent; white sucker (YOY), 16 percent; river carpsucker (YOY) and carp (YOY), 4 percent each; and emerald shiners, 1 percent.

Yellow perch (YOY) were also the dominant species in 1983, comprising 32 percent of the total number captured. Emerald shiners were second, making up 28 percent of the total; buffalo sp. (YOY) contributed 16 percent; carp (YOY), 8 percent; spottail shiners, 8 percent; white sucker (YOY), 5 percent and river carpsuckers (YOY), 2 percent.

In the Lower Missouri Arm, 58 seine hauls captured 2,869 fish in 1982. Sixty-nine seine hauls in 1983, produced 4,878 fish.

Emerald shiners were the most abundant species taken in 1982, comprising 44 percent of the total catch. Crappie sp. (YOY) made up 21 percent; yellow perch (YOY), 17 percent; buffalo sp. (YOY), 8 percent; white sucker (YOY), 4 percent and walleye 3 percent.

During 1983, the most dominant species in the Lower Missouri Arm was crappie sp., which contributed 24 percent. Spottail shiners made up 23 percent of the population; white sucker (YOY), 14 percent; yellow perch and buffalo (YOY), 12 percent each; emerald shiners, 10 percent and carp (YOY), 4 percent.

Seining in the Mid-Missouri Arm in 1982, produced 11,545 fish in 41 seine hauls. The same number of seine hauls in 1983 took 10,966 fish.

Crappie sp. (YOY) dominated the catch in 1982, making up 43 percent of the total number taken. Yellow perch (YOY) followed, comprising 37 percent of the total caught; emerald shiners, 5 percent; buffalo sp. (YOY), 5 percent; freshwater drum (YOY), 4 percent; white sucker (YOY), 2 percent and goldeye (YOY) 1 percent. In 1983, crappie sp. (YOY) made up 45 percent of the total catch in the mid-Missouri Arm. Yellow perch (YOY) comprised 25 percent of the total; emerald shiners, 22 percent and carp (YOY), 3 percent.

Seining in the Upper Missouri Arm captured 5,283 fish in 26 hauls during 1982. In 1983, 11,307 fish were taken in 55 hauls.

The most abundant species in 1982 was crappie sp., which contributed 26 percent of the catch. Goldeye (YOY) comprised 24 percent; yellow perch (YOY), 22 percent; emerald shiners 14 percent; silvery/plains minnows, white suckers (YOY), and buffalo sp. (YOY), 3 percent each; freshwater drum (YOY), 2 percent.

Crappie sp. (YOY) were also the most abundant fish captured in the upper Missouri in 1983. They made up 28 percent of the total catch. Yellow perch (YOY) comprised 24 percent; goldeye (YOY) 23 percent; emerald shiners, 11 percent; flathead chubs, 4 percent; river carpsuckers (YOY), 2 percent; freshwater drum (YOY), 2 percent and buffalo sp. (YOY), 1 percent.

Young-of-year game fish, such as walleye, northern pike and smallmouth bass, which were captured at various locations by seining in 1982 may have resulted from stocking efforts or natural reproduction. A similar situation existed in 1983, however captured northern pike resulted from natural reproduction, as no northerns were stocked during that year.

GOLDEYE MONITORING

As in previous years, periodic sampling of commercial goldeye catches occurred at a processing plant during 1982 and 1983. Samples of catches from the upper and lower Missouri arm were taken. Commercial fishermen used floating monofiliment gill nets 300- x 14- feet, with 1 3/4- inch bar mesh. The results of sampling this catch are shown in Tables 9 and 10.

Table 9. Average weights, lengths and sex composition of samples taken from commercial goldeye catches from Fort Peck Reservoir, 1982.

Area	Sex	Number	$\bar{x}$ Total Length	$\bar{x}$ Weight	Percent* Composition
Lower	M	81	13.0	0.76	19.5
	F	319	13.7	0.88	80.5
Total		400	13.5	0.85	100.0
Upper	M	195	12.7	0.69	21.7
	F	687	13.2	0.77	78.3
Total		882	13.1	0.75	100.0

*Larger sample size than goldeye measured for length and weight.

The percent composition of males and females was similar for both the upper and lower areas in 1982. Fewer females were observed in both areas in 1981 (Appendix, Table 9). The average length of females remained the same as those captured in 1981, however the length of males decreased slightly from the previous year. In the lower area, the average weight of both sexes decreased slightly from 1981 and decreased nearly 0.1 pounds for both sexes in the upper area.

Table 10. Average weights, lengths and sex composition of samples taken from commercial goldeye catches in 1983 from Fort Peck Reservoir.

Area	Sex	Number	$\bar{x}$ Total Length	$\bar{x}$ Weight	Percent* Composition
Lower	M	241	13.1	.74	33.8
	F	360	13.4	.85	66.2
Total		601	13.3	.81	100.0
Upper	M	233	12.7	.72	19.1
	F	764	12.9	.79	80.9
Total		997	12.9	.78	100.0

*Larger sample size than goldeye measured for length and weight.

The percent composition of males and females from the lower areas was significantly different in 1983. The number of females comprising the catch decreased by 14.3 percent in 1982. In the upper area, females decreased by 2.6 percent from the previous year.

Average total lengths of females from both upper and lower areas decreased slightly in 1983, while average weights increased in the upper area and decreased in the lower.

The average total length of males remained nearly the same in both areas in 1983. Average weights decreased slightly in the lower area and increased in the upper.

The two standard goldeye sampling locations in the North Fork of Duck Creek Bay were not monitored in 1982, but were in 1983. Two 300- x 8- foot monofiliment gill nets were used once during June, July and September. Both nets contain three 100- foot panels with variable mesh sizes. Bar mesh sizes of 1 1/2-, 1 5/8-, and 1 3/4- inch make up panels in Net I, and mesh sizes of 1 1/4-, 1 1/2-, and 1 3/4- inch make up Net II.

Table 11 shows the results of netting in the North Fork of Duck Creek. Net I caught an average of 63 goldeye per set, while Net II captured 104 goldeye per set. Females made up 43 percent of the catch in Net I and 58 percent in Net II. This is surprising, since adult females are of larger average size than males, and are therefore, more likely to be captured in larger mesh. The catch from both nets contained females which were of larger average size than males.

The average size of goldeye captured in 1981 were similar to those taken in 1983 (Appendix, Table 10). The average number of goldeye captured per set in 1981 was slightly higher than 1983.

Table 11. Sampling results of goldeye captured at standard monitoring sites in Duck Creek, using 300- x 8- foot floating monofiliment gill nets during 1983.

NET I (3 sets)

1 1/2-inch Bar Mesh				1 5/8-inch Bar Mesh				1 3/4-inch Bar Mesh				Total	$\bar{x}$ No./ Set
Sex	No.	$\bar{x}$ T.L.	$\bar{x}$ Wt.	Sex	No.	$\bar{x}$ T.L.	$\bar{x}$ Wt.	Sex	No.	$\bar{x}$ T.L.	$\bar{x}$ Wt.		
M	50	12.9	0.69	M	44	12.8	0.71	M	13	13.2	0.76	107	36
F	35	13.4	0.84	F	25	13.2	0.81	F	22	13.5	0.86	82	27
Total	85	13.1	0.75		69	13.0	0.74		35	13.4	0.83	189	63

NET II (3 sets)

1 1/4-inch Bar Mesh				1 1/2-inch Bar Mesh				1 3/4-inch Bar Mesh				Total	$\bar{x}$ No./Set
Sex	No.	$\bar{x}$ T.L.	$\bar{x}$ Wt.	Sex	No.	$\bar{x}$ T.L.	$\bar{x}$ Wt.	Sex	No.	$\bar{x}$ T.L.	$\bar{x}$ Wt.		
M	70	12.6	0.69	M	43	12.8	0.71	M	18	13.2	0.77	132	44
F	59	13.1	0.81	F	78	13.2	0.85	F	43	13.4	0.87	180	60
Total	130	12.8	0.75		121	13.1	0.81		61	13.3	0.84	312	104

A comparison of the pounds of goldeye captured per square foot of gill net was made from 1980 through 1983 to determine changes in netting efficiency over this period. Table 12 shows that netting efficiency, or catch per unit effort, has remained the same for all locations combined since 1981. There appears to be a significant difference, however in 1980. The reason for this difference is unknown, other goldeye monitoring techniques did not indicate a similar change in the goldeye population.

COMMERCIAL FISHING

Three residents and one nonresident were issued commercial fishing permits in 1982 and 1983. The out-of-state permittee did not fish either year. Areas of the reservoir closed to commercial fishing remained essentially the same as in 1981 (Liebelt, 1981).

The commercial catch (round weight) for 1982 was: goldeye, 208,736 pounds; buffalo sp., 123,100 pounds and river carpsucker 4,357 pounds. The total commercial catch dropped almost 200,000 pounds from 1981 (Table 13). However, in 1983 the goldeye harvest was the largest on record since commercial fishing began. The total commercial catch was 522,119 pounds, which is nearly 40,000 pounds above the average catch for the previous 10 years. The commercial catch (round weight) for 1983 was : goldeye, 403,628 pounds; buffalo sp., 111,464 pounds; carp, 5,060 pounds; river carpsucker, 1,876 pounds and freshwater drum 91 pounds.

ZOOPLANKTON

Zooplankton samples were collected monthly at seven stations throughout the reservoir, from April through October, 1983. Locations of sampling sites are shown in Figure 2. The purpose of this sampling scheme was to determine the difference in zooplankton populations in various regions of the lake, and to determine seasonal fluctuations in densities and composition of principal zooplankton at each station.

The crustacean zooplankton community was dominated by two species of cladocerans and two species of copepods throughout the sampling period. The principal cladocerans were both Daphnia sp., and copepods were Diaptomus sp. and Cyclops sp. Leptodora, the largest cladoceran sampled, was extremely rare, and made up less than 0.1 percent of the zooplankton sampled.

During the sampling period, Daphnia comprised 46 percent of the zooplankton population for all stations combined. Cyclops made up 41 percent; Cyclops nauplii, 1 percent; and Diaptomus, 12 percent. Diaptomus appeared to reach peak densities in July at most stations. Daphnia densities peaked at most stations in June, with the exception of stations one and two, which peaked in May. Population densities of Cyclops appeared to have a bimodal peak during the sampling period; one in May and the other in July.

The seasonal fluctuations in total density of principal crustacean zooplankton for each sampling station is shown in Figure 3.

Table 12. Netting efficiency of commercial fishermen at various locations on Fort Peck Reservoir from 1980 through 1983. Figures indicate pounds of goldeye taken per square foot of gill net.

	YEAR			
Area	80'	81'	82'	83'
Duck Cr.	0.019	0.010	0.012	0.014
Skunk Coulee	---	0.016	---	---
Haxby	---	0.012	---	---
3rd Point	---	---	---	0.015
Pines	---	---	0.016	0.012
6th-8th Point	---	0.011	---	0.012
Be Bee	---	---	0.014	0.010
Hell Cr.	---	---	0.009	0.008
Sutherland	0.016	0.008	0.009	.009
Snow Cr.	0.125	0.007	0.008	0.010
Wagon Coulee	0.020	0.010	0.013	0.007
Bone Trail	0.023	0.014	0.012	---
Timber Cr.	0.022	---	---	0.012
Black foot	0.021	---	---	---
Devils Cr.	0.033	0.021	0.011	0.011
Lost Cr.	0.016	---	---	---
Musselshell	0.125	---	---	0.019
All Areas Combined	0.042	0.012	0.012	0.012

Table 13. Total pounds (round weight) of commercial species harvested from Fort Peck Reservoir by commercial fishermen for years 1957 through 1983.

Year	Buffalo sp.	River Carpsucker	Carp	Carp & R.* Carpsucker	Channel** Catfish	Goldeye	Freshwater Drum	Sucker sp.	Total
1957	15,308	7,200	1,500	---	---	---	---	---	24,008
1958	176,091	---	---	25,837	100	17	107	---	202,152
1959	154,770	2,687	13,850	---	462	---	1,875	62	173,706
1960	26,435	11,500	50	---	585	---	---	---	38,570
1961	15,950	950	610	---	790	---	---	---	18,300
1962	130,842	---	---	---	22,215	---	---	---	153,057
1963	263,696	3,440	5,707	---	15,576	49	688	---	289,156
1964	145,706	3,775	1,012	---	7,492	---	1,350	---	159,335
1965	184,003	---	1,400	---	11,666	---	550	---	197,619
1966	266,142	---	---	22,935	16,879	42	2,581	---	308,579
1967	389,083	---	---	35,775	10,066	56,050	4,012	---	494,986
1968	452,230	---	---	100,774	7,749	53,318	5,445	1,625	621,141
1969	323,648	64,718	13,719	---	4,503	199,279	11,759	186	617,812
1970	437,308	49,731	8,944	---	10,619	68,384	19,287	56	594,329
1971	279,831	31,658	1,403	---	13,746	186,310	8,019	1,429	522,396
1972	474,025	40,327	10,992	---	8,060	61,830	9,228	141	604,603
1973	546,657	13,045	3,975	---	2,704	130,061	8,018	---	704,460
1974	376,850	16,719	---	---	1,011	93,825	94	---	500,638
1975	274,091	6,512	---	---	668	129,299	---	---	390,252
1976	402,543	8,456	---	---	---	91,358	---	---	502,357
1977	343,930	8,500	---	---	---	121,868	---	---	474,298
1978	243,166	6,075	---	---	---	105,919	---	---	355,160
1979	224,200	12,862	4,475	---	---	258,780	---	---	500,317
1980	178,777	8,454	5,662	---	---	356,755	509	---	550,157
1981	260,389	6,473	20,788	---	---	244,322	301	---	532,273
1982	123,100	4,357	---	---	---	208,736	---	---	336,193
1983	111,464	1,876	5,060	---	---	403,628	91	---	522,119
Total	6,820,235	309,315	99,147	185,321	134,891	2,769,830	73,914	3,499	10,396,152

*Not differentiated by commercial fishermen when reported.

**Not allowed as commercial species after June 30,1975.

Figure 2. Map of Fort Peck Reservoir showing seven stations where zooplankton, water temperatures, and water transparency were sampled in 1983.

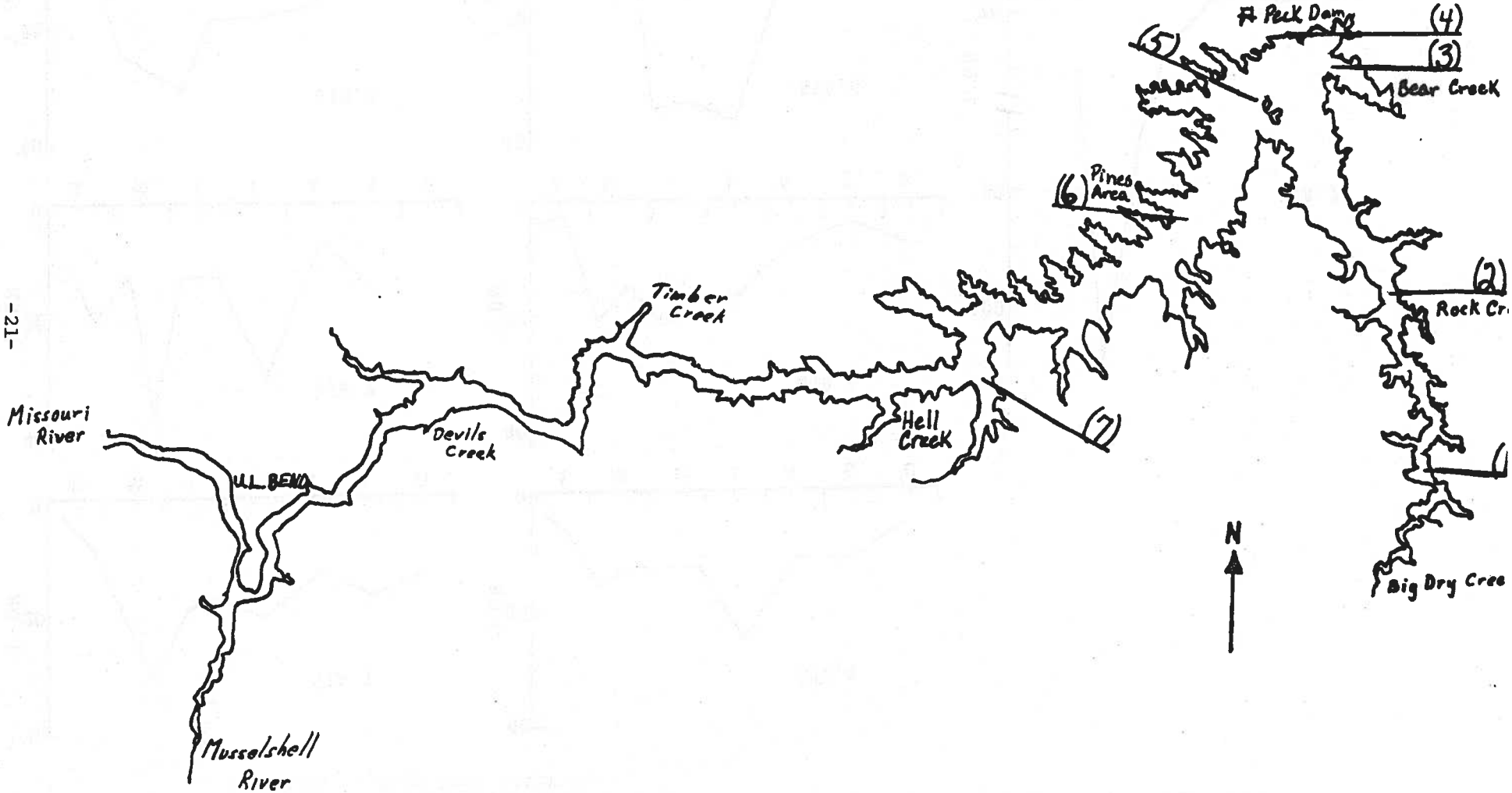
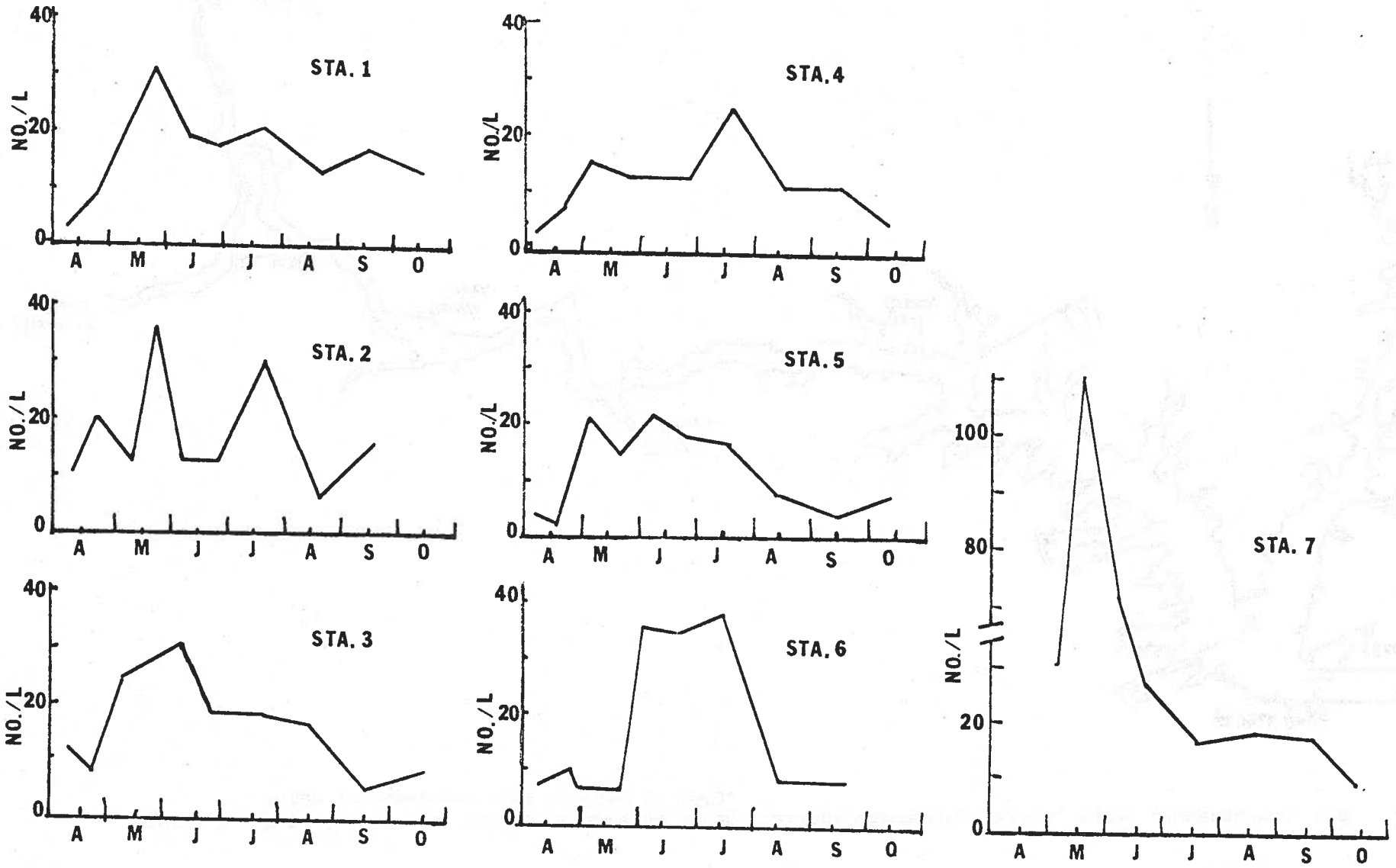


Figure 3. Seasonal trends in total density at principal crustacean zooplankton (No./L) sampled at seven stations in Fort Peck Reservoir.



Comparison of average densities of the principal zooplankton between stations revealed slight differences in densities of Daphnia sp., Diaptomus, and nauplii larvae (Table 14). Average densities of Cyclops varied widely between stations, from 3.7 per liter at station 3, to 23.6 per liter at station 7.

Comparison of total densities of all principal zooplankton from each station, indicated that the Mid-Missouri Arm was more productive than the other locations sampled (Figure 3). Casual observation of samples taken in the Mid Missouri also revealed much higher concentrations of phyotoplankton. The greater productivity of this area is probably due to a higher concentration of nutrients from the Mussselshell and Missouri Rivers.

PHYSICAL LIMNOLOGY

Temperature profiles were taken at seven standard sampling sites from June through October, 1983 (Figure 2).

Thermoclines (depth where water temperature changes 1°C or more per meter of depth) were first observed in early June in the upper Big Dry (STA 1), and Hell Creek (STA 7), (Figure 4). In July, thermoclines were recorded at stations in the vicinity of the dam (STA 3-5), and at the Pines (STA 6), (Figure 4). Thermal statification was most pronounced at most stations in August (Figure 5). The lake appeared to be less stratified in September, with only two weak thermoclines at stations 3 and 7 (Figure 5). Little if any, thermal stratification was observed in the reservoir in October (Figure 6).

The depth and width of thermoclines was variable throughout the sampling period. The average depth was approximately 60-feet, and range of depths was 16- to 85-feet. The average width of the metalimnion (area where temperature changed at least 1°C per meter of depth) was approximately 4 feet. The variance in temperature profiles was probably due to differences in wind speed, wind direction and morphometry peculiar to each sampling station.

Secchi disc readings were used to monitor water transparency at the same locations as water temperature profiles were sampled (Figures 4-6). Reservoir water at the sampling stations appeared to be less turbid in June and more turbid in September and October. Water was more transparent in the lower Missouri Arm (STA 3-5), than at other sampling locations. Turbidity was greatest in the upper Big Dry Arm (STA 1) throughout the sampling period. This was probably due to sediment which is carried into the reservoir by Big Dry Creek. Water turbidity was also higher at Hell Creek (STA 7) during the sampling period. This is probably due to the proximity of this station to the mouth of the Musselshell and Missouri rivers. Greater nutrient concentrations in these waters may be responsible for the higher densities of phyotoplankton that were observed in zooplankton sampling.

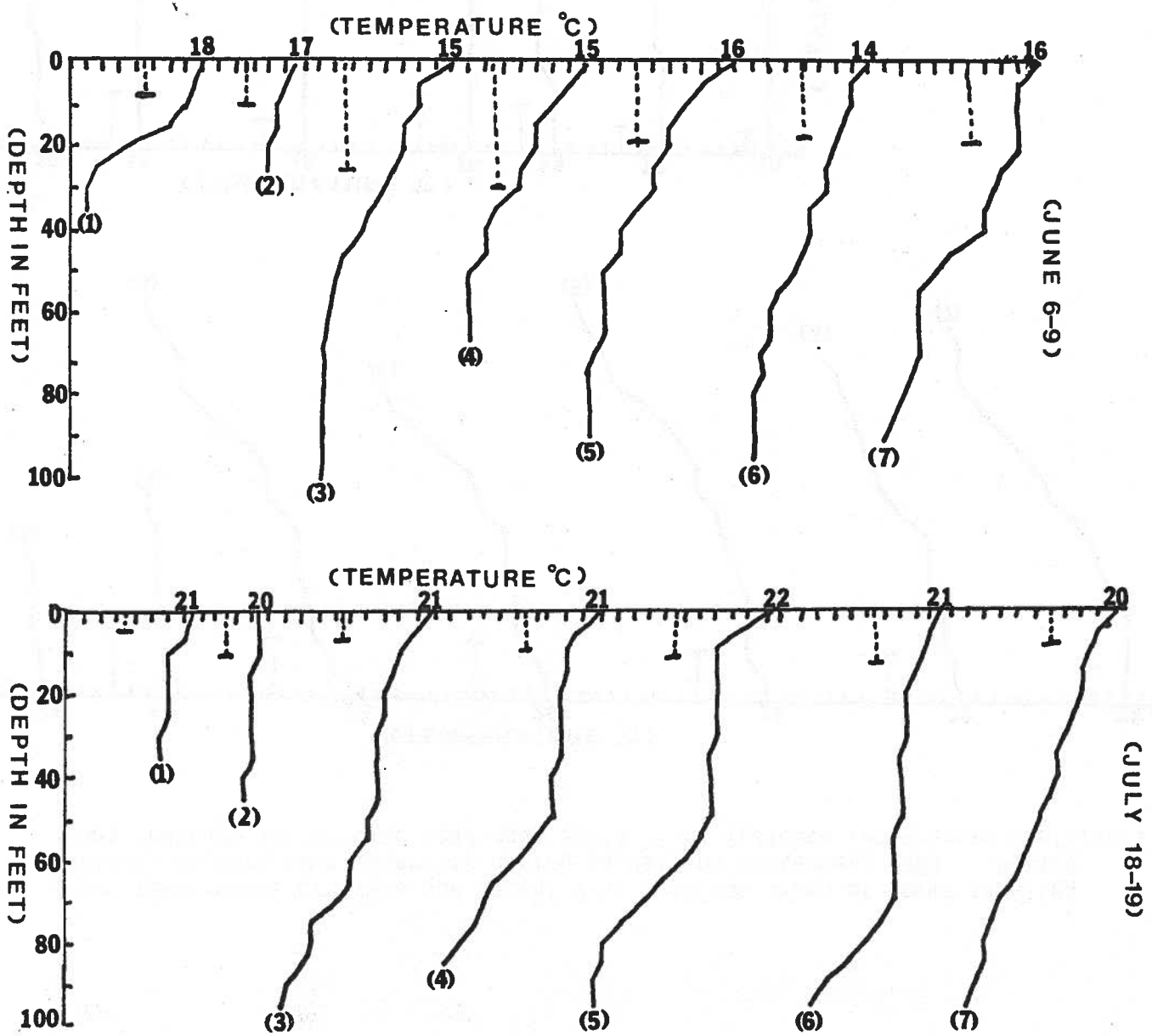
Table 14. Mean density (No./L) and range of density (in parentheses) of major zooplankton genera in 0-25 foot vertical tows collected in April through October, 1983 from seven stations on Fort Peck Reservoir. Monthly samples from each location were taken at approximately the same time, with the exceptions noted below.

	Stations[1]						
	1	2*	3	4	5	6	7+
Daphnia (B)	6.1 (0.8-15.7)	7.9 (2.1-18.5)	9.1 (1.5-26.6)	4.9 (0.5-11.3)	6.2 (0.4-17.8)	9.1 (1.2-29.0)	12.6 (3.3-39.4)
Daphnia (A)	0.1 (0.0-1.2)	0	0.1 (0.0-0.9)	0.8 (0.0-6.1)	< 0.1 (0.0-0.1)	< 0.1 (0.0-0.3)	0.2 (0.0-0.9)
Diaptomus	1.5 (0.3-3.8)	2.0 (0.5-6.3)	2.0 (0.3-5.5)	1.9 (0.1-7.5)	2.0 (0.1-9.3)	3.1 (0.3-10.7)	1.8 (0.5-3.4)
Cyclops	7.6 (1.7-14.9)	7.0 (2.0-18.5)	5.4 (1.5-10.0)	4.2 (1.2-9.4)	3.7 (1.8-7.4)	5.5 (2.2-16.9)	23.6 (2.7-95.2)
Nauplii	0.3 (0.0-2.1)	0.3 (0.0-0.5)	0.2 (0.0-0.4)	0.3 (0.0-1.5)	0.2 (0.0-0.5)	0.2 (0.0-0.5)	0.7 (0.1-2.1)

[1](1) Nelson Cr. Sta.
(2) Rock Cr. Sta.
(3) Bear Cr. Sta.
(4) Dam Sta.
(5) York Is. Sta.
(6) Pines Sta.
(7) Hell Cr. Sta.

*Due to inclement weather zooplankton sample was not obtained in October.
+Due to inclement weather zooplankton sample was not obtained in April.

Figure 4. Water temperature profiles and Secchi disc readings taken at seven sampling stations on Fort Peck Reservoir during June and July, 1983. (Dotted lines indicated Secchi disc readings, solid lines indicate temperature profiles.)



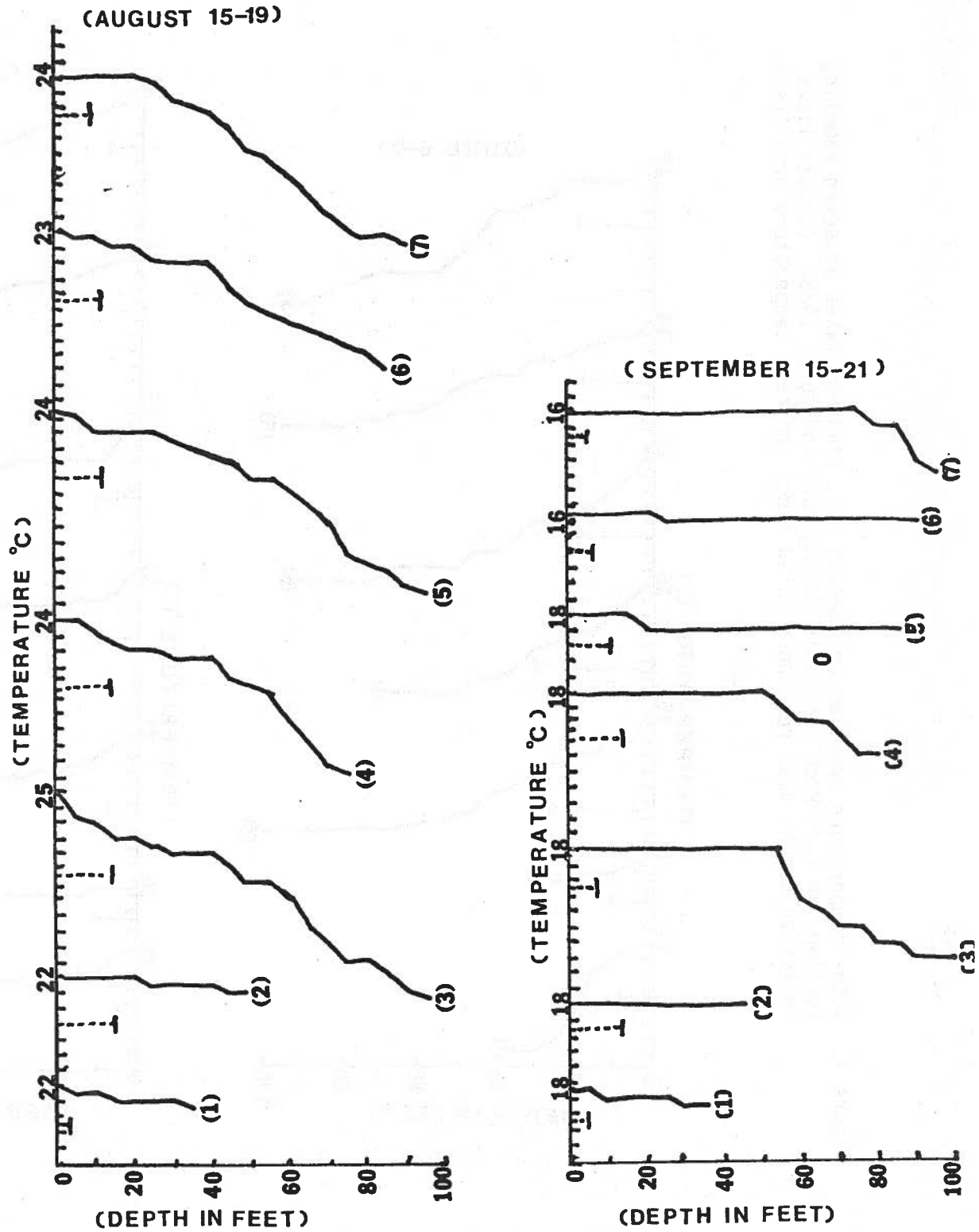


Figure 5. Water temperature profiles and Secchi disc readings taken at seven sampling stations on Fort Peck Reservoir during August and September, 1983. (Dotted lines indicate Secchi disc readings, solid lines indicate temperature profiles.)

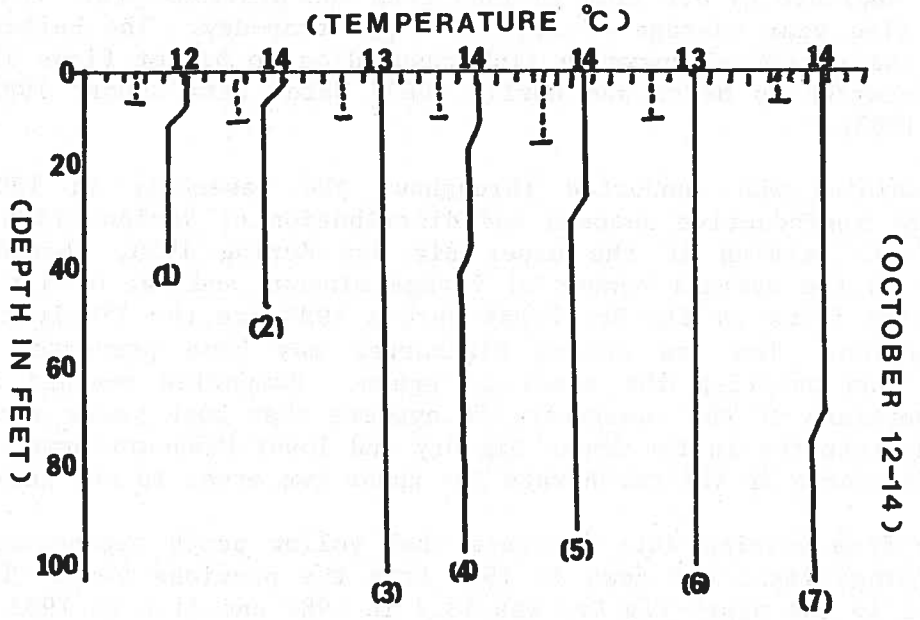


Figure 6. Water temperature profiles and Secchi disc readings taken at seven sampling stations on Fort Peck Reservoir during October, 1983. (Dotted lines indicate Secchi disc readings, solid lines indicate temperature profiles.)

DISCUSSION

Previous reports have indicated the significance of the upper Big Dry Arm to the fishery of Fort Peck Reservoir, (Liebelt, 1981). Trapping in 1982 and 1983 showed that this region continues to be heavily utilized by spring spawners. Spring trapping activities over the past five years show walleye to be the most abundant fish (Appendix, Table 2). The numbers caught per trap-day in 1983 declined slightly from 1982, but remained higher than the three preceding years.

River carpsucker and northern pike were the second and third most abundant species trapped over the past five years. The catch per trap-day for all species declined by 6.8 fish in 1983 from the previous year, but remained close to the five year average of 21.6 fish per trap-day. The better catch in 1982 may be the result of spawning fish responding to higher flows in Big Dry Creek which occurred in March and April, (USGS Water Data Report 1982 and tentative report 1983).

Beach seining was conducted throughout the reservoir in 1982 and 1983 to determine reproductive success and distribution of various fish species. Late summer/fall seining in the upper Big Dry during 1983, showed a significant decline in the overall number of forage minnows and age 0 fish taken in 1982. Low spring flows in Big Dry Creek during 1983 are the likely cause of reduced reproduction. The low spring discharges may have prevented or discouraged adults from entering the creek to spawn. Comparing overall reproduction in other portions of the reservoir, it appears that both years were similar, with small differences in the lower Big Dry and lower Missouri Arms. The reason for the differences in the catch rate for these two areas is not known.

Results from seining data indicate that yellow perch reproduction, which is a major forage fish, was down in 1983 from the previous year. The number taken per haul in the upper Big Dry was 48.7 in 1982 and 11.6 in 1983. This decrease may have resulted from lack of sufficient water levels to inundate shoreline vegetation during early spring spawning. The general decline in yellow perch abundance over the years may also be attributed to a lack of submerged vegetation essential for successful spawning of this species (Appendix Tables 3-7). Production of emerald shiners, another important forage fish, was up slightly in 1983. The number captured per sein haul was 7.1 in 1983 and 2.4 in 1982. The increase of emeralds may be attributed to better spawning and rearing conditions in early summer, 1983, when water levels reached sufficient height to flood shoreline vegetation.

Gravid spottail shiners were stocked in late June, 1983 to augment the declining forage base. Spottails successfully reproduced, and young-of-year were seined throughout the Big Dry Arm and lower Missouri Arm during the fall, 1983.

Seining indicated that walleye fingerlings and fry planted in 1983 did not fair well. The reason for their apparent scarcity may be due to heavy predation, or abandonment of areas where they were initially stocked.

Results from seining in 1983 indicate that smallmouth bass plants were more successful than those made in 1982. The reason for this improvement is unknown.

No northern pike fry or fingerlings were stocked in 1983, however, a small quantity of young-of-year were captured in fall seining. This would indicate that some natural reproduction did occur, if only on a limited scale. Northern pike were stocked in June, 1982 at the Pines and in the lower Missouri Arm. Young-of-year were captured by seining at these locations and also in the lower and upper Big Dry Arm. Fingerlings taken in the upper Big Dry may have resulted from natural reproduction.

Crappie sp. were taken in relatively large numbers in fall seining during both years in the mid and upper portions of the Missouri Arm. These resulted from natural reproduction as no stocking occurred for this species. In spite of the large number of young produced, very few adults or juveniles are captured by gill netting, trapping or by anglers. The apparent lack of adults may be the result of heavy predation on young by piscivorous fish in these areas.

Gill netting results from both 1982 and 1983, indicate that the upper Missouri Arm has the greatest abundance of goldeye relative to other sampling areas. This information combined with average size data, and seining data, indicates that this area may be the major rearing site for the reservoir's goldeye population.

Gill netting data continues to show that walleye are most abundant in the Big Dry and lower Missouri Arms. This is attributed mainly to an intensive stocking program in these areas over the past years, and does not necessarily indicate superior walleye habitat. Recent zooplankton samples and beach seining efforts throughout the reservoir, indicate that the mid and upper Missouri Arms are more productive, and should therefore provide more forage for walleye. It is possible that the walleye population may be enhanced by increasing stocking efforts in the upper portion of the reservoir.

Monitoring of goldeye commercial catches periodically throughout the study period indicated that a change in population structure may have occurred. This may have resulted from the large commercial harvest in 1983; however, evidence is inconclusive at this time. The weight and size of goldeye sampled from commercial catches does not indicate a significant population change.

A summary of commercial goldeye sampling from 1977 through 1983 is shown in the Appendix, Table 8. Comparing the sex composition of the goldeye catch in 1982 and 1983 in the lower Missouri Arm with catches from the previous five years, it appears that the percentage of females comprising the catch has declined. The average weight for females in 1982 of 0.88 pounds was slightly above the previous five year average of 0.86 pounds. The average weight of males was 0.01 pounds above the five year average of 0.75 pounds.

The average weight of female goldeye in 1983 was 0.02 pounds below the 1977-1981 average. Males were 0.01 pounds below the 1977-1981 average.

In the upper Missouri Arm, the percent of females comprising the commercial catch in 1982 and 1983 also declined from the previous years. The average weight for females and males in 1982 (0.77 and 0.69 pounds) was 0.05 pounds below the average for the previous three years. Average weight in 1983 for females (0.79 pounds) was 0.03 pounds below the 1979-1981 average. Males averaged 0.72 pounds, which was 0.02 pounds below the 1979-1981 average.

Information on the principal zooplankton populations and the physical limnology of the reservoir has already provided some insight into the dynamics of the fishery. Collection of this data will continue through the next project period. Additional sampling sites will be selected in the upper Missouri Arm to obtain a more complete understanding of these parameters and their effect on the fishery.

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United States Geological Survey. 1982 Water resources data for Montana, water year 1982. U.S.G.S. Water Data Report MT-82-1.

Ward, James 1955. A Description of a new Zooplankton Counter. Quarterly Journal of Microscopial Science 96:371-73.

APPENDIX

Table 1. List of fish species found in Fort Peck Reservoir.

1.	Pallid sturgeon	*Scaphirhynchus albus*
2.	Shovelnose sturgeon	*Scaphirhynchus platorynchus*
3.	Paddlefish	*Polyodon spathula*
4.	Goldeye	*Hiodon alosoides*
5.	*Cisco	*Coregonus artedii*
6.	Mountain whitefish	*Prosopium williamsoni*
7.	*Chinook salmon	*Oncorhynchus tshawytscha*
8.	*Coho salmon	*Oncorhynchus kisutch*
9.	*Kokanee salmon	*Oncorhynchus nerka*
10.	*Rainbow trout	*Salmo gairdneri*
11.	*Brown trout	*Salmo trutta*
12.	*Lake trout	*Salvelinus namaycush*
13.	*Northern Pike	*Esox lucious*
14.	*Carp	*Cyprinus carpio*
15.	Northern redbelly dace	*Phoxinus eos*
16.	Longnose dace	*Rhinichthys cataractae*
17.	Emerald shiner	*Notropis atherinoides*
18.	Sand shiner	*Notropis stramineus*
19.	*Spottail shiner	*Notropis hudsonius*
20.	Fathead minnow	*Pimephales promelas*
21.	Plains minnow	*Hybognathus placitus*
22.	Silvery minnow	*Hybognathus argyritis*
23.	Brassy minnow	*Hybognathus hankinsoni*
24.	Lake chub	*Couesius plumbeus*
25.	Creek chub	*Semotilus atromaculatus*
26.	Flathead chub	*Hybopsis gracilis*
27.	River carpsucker	*Carpiodes carpio*
28.	Blue sucker	*Cycleptus elongatus*
29.	Smallmouth buffalo	*Ictiobus bubalus*
30.	Bigmouth buffalo	*Ictiobus cyprinellus*
31.	Shorthead redhorse	*Moxostoma macrolepidotum*
32.	Longnose sucker	*Catostomus catostomus*
33.	White sucker	*Catostomus commersoni*
34.	Black bullhead	*Ictalurus melas*
35.	Channel catfish	*Ictalurus punctatus*
36.	Stonecat	*Noturus flavus*
37.	Burbot	*Lota lota*
38.	*Plains killifish	*Fundulus zebrinus*
39.	*Smallmouth bass	*Micropterus dolomieui*
40.	*White crappie	*Pomoxis annularis*
41.	*Black crappie	*Pomoxis nigromaculatus*
42.	*Yellow perch	*Perca flavescens*
43.	Sauger	*Stizostedion canadense*
44.	*Walleye	*Stizostedion vitreum*
45.	Iowa darter	*Etheostoma exile*
46.	Freshwater drum	*Aplodinotus grunniens*

*Introduced

Table 2. Species and number of various fish captured in spring trap netting in the upper Big Dry Arm of Fort Peck Reservoir, 1977-1981. Number of fish caught per trap-day is in parentheses.

	SPECIES[1]																
	WE	SG	YP	NP	RC	WS	SR	SB	C	GE	CC	B	BLB	BB	RT	FD	Total* Fish	Trap-Days
DATE																		
1981	371 (2.7)	73 (0.5)	76 (0.5)	98 (0.7)	121 (0.9)	215 (1.5)	99 (0.7)	48 (0.3)	95 (0.7)	114 (0.8)	16 (0.1)	44 (0.3)					1,374 (9.8)	140
1980	535 (5.5)	57 (0.6)	63 (0.6)	301 (3.1)	612 (6.6)	177 (1.8)	142 (1.5)	112 (1.2)	98 (1.0)	12 (0.1)		70 (0.7)					2,222 (22.9)	97
1979	325 (4.3)	39 (0.5)	15 (0.2)	283 (3.8)	139 (1.8)	13 (0.2)	8 (0.1)	119 (1.6)	161 (2.1)	121 (1.6)		30 (0.4)					1,261 (16.8)	75
1978	1,839 (22.7)	83 (1.0)	26 (0.3)	400 (4.9)	246 (3.0)	193 (2.4)	133 (1.6)	180 (2.2)	71 (0.9)	265 (3.3)	3 (<0.1)	47 (0.6)	28 (0.3)	7 (0.1)	1 (<0.1)		3,522 (43.2)	81
1977	1,700 (5.8)	43 (0.2)	145 (0.5)	415 (1.4)	654 (2.2)	139 (0.5)	185 (0.6)	67 (0.2)	223 (0.8)		36 (0.1)	46 (0.2)	377 (1.3)			22 (0.1)	4,070 (13.8)	295

[1] WE= walleye, SG= sauger, YP= yellow perch, NP= northern pike, RC= river carpsucker, WS= white sucker, SR= shorthead redhorse sucker, SB= smallmouth buffalo, C= carp, GE= goldeye, CC= channel catfish, B= burbot, BLB= black bullhead, BB= bigmouth buffalo, RT= rainbow trout, FD= freshwater drum

*May include more species than those listed; less than 0.1 fish caught per trap-day. blue sucker, shovelnose sturgeon

Table 3. Species and number of Age 0 and forage species captured by beach seining in Fort Peck Reservoir during 1981; average number per haul in parentheses (Liebelt, 1981).

		Species[1]																	
		WE	SG	YP	NP	GE	C	RC	B	SS	WS	LS	CC	BU	CR	FD	SB	FM[2]	U	
Area	No. of Hauls																			Totals
Big Dry Arm[3]	56	17 (0.3)	1 (0.1)	1,358 (24.2)	4 (0.1)	0	908 (16.2)	394 (7.0)	928 (16.6)	48 (0.9)	196 (3.5)	0	2 (0.1)	1 (0.1)	40 (0.7)	138 (2.5)	0	678 (12.1)	6 (0.1)	4,719 (84.3)
Lower Areas[4]	54	15 (0.3)	14 (0.3)	2,374 (44.0)	14 (0.3)	113 (2.1)	13 (0.2)	17 (0.3)	63 (1.2)	0	251 (4.7)	0	0	1 (0.1)	3,041 (56.3)	271 (5.0)	0	1,584 (29.3)	0	7,771 (143.9)
Upper Areas[5]	32	1 (0.1)	55 (1.7)	4,367 (136.5)	0	1,246 (38.9)	126 (3.9)	74 (2.3)	261 (8.2)	27 (0.8)	4 (0.1)	1 (0.1)	8 (0.3)	0	307 (9.6)	713 (22.3)	19 (0.6)	545 (17.0)	0	7,754 (242.3)

[1] WE= walleye; SG= sauger; YP= yellow perch; NP= northern pike; GE= goldeye; C= carp; RC= river carpsucker; B= buffalo sp.; SS= shorthead redhorse sucker; WS= white sucker; LS= longnose sucker; CC= channel catfish; BU= burbot; CR= crappie sp.; FD= freshwater drum; SB= smallmouth bass; FM= forage minnows; U= unknown

[2] FM, Big Dry Arm= creek chub, lake chub, emerald shiner, silvery minnow, fathead minnow, longnose dace, plains killifish.
FM, Lower Areas= lake chub, emerald shiner, silvery minnow.
FM, Upper Areas= flathead chub, lake chub, emerald shiner.

[3] Big Dry Arm= Nelson, McGuire, Lonetree, Bug, Sand Arroyo, South Fork Rock Creek, Box Elder, Stone House bays.

[4] Lower Areas= Bear, Spillway, North Fork Duck, Rainbow, Pines, Gilbert bays.

[5] Upper Areas= Hell, Jim Wells, Soda, Crooked, Musselshell bays.

Table 4. Species and number of Age 0 fish and forage minnows captured by beach seining in Fort Peck Reservoir during 1980; average number per haul in parentheses (Liebelt, 1981).

		Species[1]																				
		YP	WE	SG	NP	C	B	WS	SH	CR	FD	CC	GE	ES	LC	FM	SM	SS	LD	ND	BM	PK	
Area	No. of Hauls																						Totals
Big Dry[2] Arm	36	1,671 (46.4)	2 (0.1)	0	0	5 (0.1)	0	0	3 (0.1)	3 (0.1)	79 (2.2)	3 (0.1)	3 (0.1)	31 (0.9)	20 (0.6)	0	5 (0.1)	0	2 (0.1)	1 (0.1)	1 (0.1)	1 (0.1)	1,830 (50.8)
Lower[3]	39	2,044 (52.4)	2 (0.1)	3 (0.1)	2 (0.1)	10 (0.3)	19 (0.5)	157 (4.0)	0	297 (7.6)	5 (0.1)	0	5 (0.1)	99 (2.5)	1 (0.1)	0	0	0	0	0	0	0	2,644 (67.8)
Hell[4]	8	5,657 (707.1)	0	0	0	0	0	3 (0.4)	0	376 (47.0)	12 (1.5)	0	0	81 (10.1)	0	3 (0.4)	0	1 (0.1)	1 (0.1)	0	0	0	6,134 (766.8)

[1] YP= yellow perch; WE= walleye; SG= sauger; NP= northern pike; C= carp; B= buffalo sp.; WS= white sucker; SH= shorthead redhorse sucker; CR= crappie sp.; FD= freshwater drum; CC= channel catfish; ES= emerald shiner; LC= lake chub; FM= fathead minnow; SM= silvery minnow; SS= sand shiner; LD= longnose dace; ND= northern redbelly dace; BM= brassy minnow; PK= plains killifish

[2] Big Dry Arm= Timber, Nelson, Lonetree, McGuire, Lost bays.

[3] Lower= spillway, Rainbow, Sturgeon bays.

[4] Hell= Hell Bay.

Table 5. Species and number of Age 0 fish and forage minnows captured by beach seining in Fort Peck Reservoir during 1979; average number per haul in parentheses (Liebelt, 1981).

		Species[1]															
		YP	WE	SG	NP	B	WS	SH	CR	FD	ES	LC	SM	FM	SS	LD	
Area	No. of Hauls																Totals
Big Dry Arm[2]	27	2,069 (76.6)	5 (0.2)	0	1 (0.1)	1 (0.1)	0	1 (0.1)	0	60 (2.2)	70 (2.6)	17 (0.6)	0	0	0	1 (0.1)	2,225 (82.4)
Lower[3]	17	4,121 (179.2)	0	0	13 (0.6)	0	13 (0.6)	0	94 (4.1)	0	33 (1.4)	0	0	0	0	0	4,274 (251.4)
Upper[4]	17	571 (33.6)	0	3 (0.2)	0	0	2 (0.1)	0	259 (15.2)	13 (0.8)	223 (13.1)	1 (0.1)	9 (0.5)	6 (0.4)	2 (0.1)	0	1,089 (64.1)

[1] YP= yellow perch; WE= walleye; SG= sauger; NP= northern pike; C= carp; B= buffalo sp.; WS= white sucker; SH= shorthead redhorse sucker; CR= crappie sp.; FD= freshwater drum; ES= emerald shiner; LC= lake chub; SM= silvery minnow; FM= fathead minnow; SS= sand shiner; LD= longnose dace

[2] Big Dry Arm= Timber, Nelson, Lonetree, McGuire bays.

[3] Lower= Rainbow, Sturgeon, North Fork Duck, Fourth, Pines bays.

[4] Upper= Hell, Timber bays.

Table 6. Species and number of Age 0 fish and forage minnows captured by beach seining in Fort Peck Reservoir during 1978; average number per haul in parentheses (Liebelt, 1981).

		Species[1]											
		YP	WE	NP	C	B	WS	FD	CR	BU	ES	FM	
Area	No. of Haul												Totals
Big Dry Arm[2]	24	1,158 (48.3)	9 (0.4)	8 (0.3)	3 (0.1)	6 (0.3)	63 (2.6)	3 (0.1)	2 (0.1)	0	926 (38.6)	141 (5.9)	2,319 (96.6)
Lower[3]	10	3,275 (327.5)	9 (0.9)	19 (1.9)	0	0	0	0	145 (14.5)	1 (0.1)	23 (2.3)	0	3,472 (347.2)
Hell Creek Bay	9	5,277 (586.3)	0	2 (0.2)	0	1 (0.2)	0	0	409 (45.4)	0	3 (0.3)	0	5,692 (632.4)

[1] YP= yellow perch; WE= walleye; NP= northern pike; C= carp; B= buffalo sp.; WS= white sucker; FD= freshwater; CR= crappie sp.; BU= burbot; ES= emerald shiner; FM= forage minnows: includes lake chub, silvery minnow, fathead chub

[2] Big Dry Arm= Nelson, Little Bug, Bug, Black Coulee, South Fork Rock Creek bays.

[3] Lower= North Fork Duck bay.

Table 7. Species and number of Age 0 fish and forage minnows captured by beach seining in Fort Peck Reservoir during 1977, average number per haul in parentheses (Liebelt, 1981).

		Species[1]															
		YP	WE	NP	FD	CC	CR	WS	RC	ES	SM	FC	FM	LC	LD	CB	
Area	No. of Hauls																Totals
Big Dry Arm[2]	58	6,413 (110.6)	13 (0.2)	0	2,586 (44.6)	5 (0.1)	159 (2.7)	9 (0.2)	1 (0.1)	2,787 (48.1)	196 (3.4)	6 (0.1)	11 (0.2)	51 (0.9)	1 (0.1)	1 (0.1)	12,239 (211.0)
Lower[3]	25	7,043 (281.7)	19 (0.8)	5 (0.2)	12 (0.5)	0	454 (18.2)	851 (34.0)	0	9,388 (375.5)	1 (0.1)	2 (0.1)	4 (0.2)	9 (0.4)	0	0	17,788 (711.5)

[1] YP= yellow perch; WE= walleye; NP= northern pike; FD= freshwater drum; CC= channel catfish; CR= crappie sp.; WS= white sucker; RC= river carpsucker; ES= emerald shiner; SM= silvery minnow; FC= flathead chub; FM= fathead minnow; LC= lake chub; LD= longnose dace; CB= creek chub

[2] Big Dry Arm= Head, Nelson, McGuire, Lonetree, Lost, Bug, Rock bays.

[3] Lower= Spillway, North Fork Duck, Dam, Rainbow bays.

APPENDIX

Table 8. Summary of samples taken from commercial goldeye catches from Fort Peck Reservoir, 1977-1983.

Lower[1]		Number		Avg. T.L.		Avg. Wt.		Percent Composition	
	Year	F	M	F	M	F	M	F	M
	'77	198	33	13.6	13.0	0.88	0.77	86.0	14.0
	'78	209	11	13.2	12.4	0.82	0.72	95.0	5.0
	'79	419	43	13.5	12.6	0.85	0.73	90.7	9.3
	'80	1,233	252	13.6	13.1	0.87	0.77	83.0	17.0
	'81	708	118	13.7	13.2	0.89	0.77	87.5	12.5
	'82	319	81	13.7	13.0	0.88	0.76	80.5*	19.5*
	'83	360	241	13.4	13.1	0.84	0.74	66.2*	33.8*
Upper[2]		F	M	F	M	F	M	F	M
	'77	---	---	---	---	---	---	---	---
	'78	---	---	---	---	---	---	---	---
	'79	787	65	13.2	12.7	0.83	0.72	92.4*	7.6
	'80	179	18	13.2	13.0	0.84	0.79	93.6*	6.4*
	'81	912	158	13.2	12.9	0.80	0.72	85.6*	14.4*
	'82	687	195	13.2	12.7	0.77	0.69	78.3*	21.7*
	'83	764	233	12.9	12.7	0.79	0.72	80.9*	19.1*

[1]Lower= The lower 30 miles of the Missouri arm.

[2]Upper= The upper 30 to 70 miles of the Missouri arm, above Ft. Peck Dam.

*Figures include additional numbers of goldeye which were selected at random from commercial catch.

APPENDIX

Table 9. Sampling results of commercial goldeye catches from lower and upper areas of Fort Peck Reservoir during 1981 (Liebelt, 1981).

Area	Sex	Number/Total	Average Length	Average Weight	Percent* Composition
Lower	Male	118	13.2	0.77	12.5
	Female	708	13.7	0.89	87.5
	Total	826	13.63	0.87	100.0
Upper	Male	158	12.9	0.72	14.4
	Female	912	13.2	0.80	85.6
	Total	1,070	13.2	0.79	100.0

*Based on additional numbers of goldeye sexed from random sampling of total catch.

Table 10. Results of goldeye sampling at standard monitoring sites in Duck Creek bay using 300- x 8-foot floating monofilament gill nets during summer and fall, 1981 (Liebelt, 1981).

NET I

No. of Sets	1 1/2-inch Bar				1 5/8-inch Bar				1 3/4-inch Bar				Total	Avg. No. Per Set
	Sex	No.	Avg. T.L.	Avg. Wt.	Sex	No.	Avg. T.L.	Avg. Wt.	Sex	No.	Avg. T.L.	Avg. Wt.		
3	M	42	12.8	0.68	M	28	12.8	0.69	M	7	13.1	0.76	77	25.7
	F	78	13.3	0.76	F	86	13.4	0.80	F	63	13.7	0.83	227	75.7
	Total	120	13.1	0.73		114	13.3	0.77		70	13.6	0.83	304	101.3

NET II

	1 1/4-inch Bar				1 1/2-inch Bar				1 3/4-inch Bar					
3	M	60	12.6	0.63	M	60	12.7	0.65	M	17	12.8	0.67	137	45.7
	F	35	13.0	0.72	F	39	13.4	0.79	F	28	13.5	0.83	102	34.0
	Total	95	12.7	0.66		99	13.0	0.70		45	13.2	0.77	239	79.7

507/1